

REMARKS

This is in response to the Office Action dated November 27, 2007. In view of the foregoing amendments and following representations, reconsideration is respectfully requested.

Initially, the specification and abstract have been reviewed and revised, and a substitute specification and abstract has been prepared. No new matter has been added. Also enclosed is a "marked-up" copy of the original specification and abstract to show the changes that have been incorporated into the substitute specification and abstract. The enclosed copy is entitled "Version with Markings to Show Changes Made."

By the above amendment, claims 17-36 are cancelled; and claims 37-53 are newly presented. Thus, claims 37-53 are currently pending in the present application.

* * * *

On pages 2-4 of the Office Action, the drawing are objected to as 1) not including reference sign(s) that are described in the specification; 2) including reference character(s) that are not described in the specification; and 3) not showing features of the invention that are specified in the claims. Accordingly, the drawings have been corrected in an attempt to overcome the informalities noted by the Examiner. A set of replacement drawings, incorporating the changes that are described below, is submitted herewith.

-With respect to the objection to the drawings on page 2 of the Office Action, the reference numeral (N) used in claim 17, representing "the normal N to the interface between said high-resistivity formation (2) and said lower-resistivity formation (3)" has been added in Fig. 1, Figs. 3a, 3b, 3c, and 3d.

-Reference numeral S2 has been added to Figs. 1 and 2.

-Reference numerals S1, S2, and R3 have been added to Fig. 3a, b, c, and d.

-Reference numeral F3 has been added to Figs. 7 and 8. Note that F3 represents a refracted wave front propagating upwards through the low-resistive geological formations 3.

-Reference numeral 74, which represents a high-resistivity cement, has been added to Fig. 3a.

-Reference numeral A2, which represents an area of lower conductivity, has been corrected in Figs. 3a and 3b.

On page 3 of the Office Action, the Examiner states that reference numeral 50 is not mentioned in the description. However, reference numeral 50 is described on page 11, line 15 of the specification as originally filed. Further, reference numeral 2o is described on page 11, line 23 of the specification as originally filed. Note that reference character 2oil has been changed to 2o in Fig. 1, Fig. 3a, and Fig 3b to clearly distinguish the oil-bearing high-resistivity formation from the corresponding water-bearing formation identified by reference character 2w.

Further, the Poynting vectors P_{\perp} and P_{\parallel} , which are described on page 15, line 9, can now be found in corrected Fig. 3b.

Further, the toroidal antenna 50 with ring core 51 is indicated in Figs. 3b, 3c and 3d. A toroidal antenna may be a toroidally wound coil producing a toroidal magnetic field, which is not easily illustrated other than by indicating a ring such as shown in the above identified figures. Note, a coil is now shown in corrected Fig. 3d by inserting and indicating an enlarged view of part of the drawing figure.

In view of the above, it is submitted that the objections to the drawings are now clearly obviated by the presentation of the replacement drawings.

* * * *

Next, on pages 4-6 of the Office Action, claims 17-19, 25-27, 29-32 and 34-35 are objected to based on informalities identified by the Examiner. As indicated above, claims 17-36 have been cancelled and replaced with new claims 37-53, thereby rendering the objection moot. Further, each of the new claims has been drafted to conform with 35 U.S.C. 112, second paragraph and to avoid the informalities noted by the Examiner on pages 5-6.

In particular, claim 37 (which generally corresponds to cancelled claim 17) the phrase "exit angle nearer to normal N" has been changed to the phrase "..., said electromagnetic signal (R_3) rising from an interface between said high-resistivity formation (2) and said lower-resistivity formation (3)...". This language avoids any reference to the "normal N" which is a physical description of the refraction.

Further, claim 43 (which generally corresponds to cancelled claim 18) the phrase "an electrically conductive string" has been changed to "said electrically conductive string".

Further, with regard to objection to claim 34, the Examiner takes the position that this claim is a duplicate of claim 21, as both claims depended on claim 18. This objection has been avoided in the new claims.

Furthermore, with respect to new claim 52 (which generally corresponds to cancelled claim 32), the higher and lower resistivity formations (2, 3) were reversed. Accordingly, claim 52 has been written so that the terms "higher" and "lower" have been put in the correct order to

conform with the description and the original drawings, such as Fig. 3a, in which reference numeral (2) indicates the higher-resistivity formation has a resistivity of 20 to 100 Ohm-meter, and reference numeral (3) indicates the overlying lower-resistivity formations having resistivities of 0.7 to 3 Ohm-meter. Support can be found at least on page 7, lines 23-27 and page 10, lines 4-9 of the specification, as originally filed.

Further, in claims 50-51 (which correspond to cancelled claims 27-28) the language "or frequencies" has been avoided.

Furthermore, each of the new claims has been drafted to provide proper antecedent basis for each recited element. Also, in claim 44 (which corresponds to cancelled claim 19) the language "is used" has been avoided, and the recitation of "electrodes" has been corrected to "two electrodes". The basis for this language can be found in Figs. 1-2 which show electrodes 50A, 50B. Also see page 12, line 28 to page 13, line 8 of the specification.

Further, with respect to claim 38 (which corresponds to cancelled claim 25), the language "for integrating" refers to the feature that the signal is injected at the top of the well string, which is integrated as part of the signal path for transmitting the signal downwards through the geological formations. Moreover, in claim 38 the phrase, "... and of which a second of said electrodes (50B) is grounded, said first and second electrodes (50A, 50B)" has been added. Support for this feature can be found on page 12, line 28 to page 13, line 1; and support for the phrase "said electrodes (50B) is grounded" can be found on page 13, lines 6-8..

Further, with response to claim 39 (which corresponds to cancelled claim 26) the language "a propagating EM signal" has been changed to read "... for propagating said

electromagnetic signals along said electrically conductive string."

Further, claim 40 (which corresponds to claim 29) has been written to avoid the term "possibly." Support for claim 40 can be found in at least on page 12, line 22 to page 14, line 13 and in Fig. 1, Fig. 3a (area range A1 of high resistivity and area range A2 having low resistivity), Fig. 3b, and particularly Fig. 3c.

In view of the above, it is submitted that the objection to the previous claims has been obviated by the presentation of new claims 37-53.

* * * *

Next, on pages 6-7 of the Office Action, claims 17, 18, 20-24, 27, 28, 30 and 33-36 are rejected under 35 U.S.C. 102(e) as being anticipated by Ellingsrud et al. (U.S. Patent No. 6,859,038).

Initially, it is noted that claim 32 was considered allowable by the Examiner. As indicated above, new independent claim 52 corresponds to claim 32 and is therefore similarly allowable particularly in light of the changes noted above. Further, claim 53 depends on claim 52, and is therefore allowable at least by virtue of its dependency.

Further, new independent claim 37 includes the limitations of claim 17 and dependent claim 19, which was indicated to be allowable by the Examiner. Therefore, independent claim 37 is allowable, along with dependent claims 38-42. Note the only substantive deviation from claim 17 is that the language "or land surface" has not been presented in independent claim 37. The omission of this language should not negatively affect the patentability of claim 37.

In view of the above, it would appear that the sole remaining issue is the allowability of

new independent claim 43, which generally corresponds to cancelled claim 18. It is submitted that claim 43 is clearly allowable over the Ellingsrud reference for the following reasons.

In the rejection of claim 18 the Examiner takes the position that Ellingsrud discloses that the transmitter may be located in an existing well. In particular, the Examiner states:

"Thus, the electromagnetic signal would propagate along the conductive string, (note fig. 2, 43a)."

The Examiner is respectfully requested to reconsider this interpretation of item 43a in Ellingsrud, because reference numeral 43a indicates a steeply propagating ray path for an electromagnetic signal having a critical angle for being refracted to a ray-path with reference numeral 43 having a horizontal propagation direction along the high-resistivity layer 35 of Fig. 2 of the Ellingsrud reference. Also, the upwardly propagating refracted wave 43c is drawn with the same angle in Ellingsrud. Furthermore, as described in col. 3, lines 6-10:

"Conveniently, there will be a single transmitter and an array of receivers, the transmitter(s) and receivers being dipole antennae or coils, though other forms of transmitter/receivers can be used. The transmitter may be in an existing well."

Thus, Ellingsrud discloses that the transmitter may comprise coils, but lacks any disclosure of a coil in combination with an electrically conductive string in the well. Further, Ellingsrud does not teach the use of using an electrically conductive string in a well as a waveguide for improving the efficiency of injecting an electromagnetic signal into a high-resistivity formation according to the invention, a feature that removes much of the significant signal loss due to attenuation of the downwards propagating signal through the otherwise

conductive geological layers. Accordingly, it is submitted that the present invention, as defined in independent claim 43, is clearly allowable over the Ellingsrud reference. Also, claims 44-51 depend, directly or indirectly from claim 43, and are therefore allowable at least by virtue of their dependencies.

In view of the above, it is submitted that the present application is now clearly in condition for allowance. The Examiner therefore is requested to pass this case to issue.

In the event that the Examiner has any comments or suggestions of a nature necessary to place this case in condition for allowance, then the Examiner is requested to contact Applicant's undersigned attorney by telephone to promptly resolve any remaining matters.

Respectfully submitted,

Svein Erling JOHNSTAD et al.

By: 
Michael S. Huppert
Registration No. 40,268
Attorney for Applicants

MSH/kjf
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
May 27, 2008